REMARKS/ARGUMENTS

The amendment to claim 1 incorporates the limitations of now-cancelled claim 14 into claim 1. With the incorporation of the limitations of claim 14 into claim 1, claim 1 is restricted to an apparatus arranged to perform pinched injection as depicted in FIGs. 5A and 5B. Pinched injection occurs in the first multiport valve position as depicted in FIG. 5A, and is effected using mechanical pumping at both ends of the second covered channel while the sample is being pumped through the first channel. In the second position of the multiport valve, the first channel is connected in a closed loop, and the second channel is disconnected from one of the pumps so that a second fluid can be transported in the second channel while a constant pressure is maintained in both arms of the first channel.

There is a fundamental difference between Ramsey and the present invention, in that Ramsey uses electrokinetic injection, whereas the invention is a pressure-driven microfluidic device. The Examiner has taken the position that, because Knapp et al. teach that electrokinetic control systems and micro-pump and valve systems (i.e., pressure-driven systems) are equivalent means to control flow through channels in microfluidic devices, it would have been obvious to use pressure-driven systems in Ramsey's apparatus. The Applicants respectfully disagree with the conclusion that electrokinetic and pressure-driven systems are equivalent. It is true that in col. 10, lines 12-19, Knapp et al. list electrokinetic systems and micro-pump and valve systems, *inter alia*, as possible alternatives for use in their analyzers. However, this does not mean that it is always obvious to substitute one such device for the other. For example, a brush, a carpet sweeper and a vacuum cleaner can all be used to clean a carpet, but

that does not make it obvious to use a brush to perform a completely different task, such as inflation of an air mattress, previously described as performed by a vacuum cleaner.

Apart from the different flow control means, the flow profiles are completely different in pressure-driven and electrokinetically driven microsystems. In particular, in a pressure-driven system, the flow rates are essentially zero at the walls of the channel and have a maximum value at the center. In an electrokinetic system however, the rate is almost uniform across the entire channel section, since it is the movement of charges at the walls that generates the flow. In short, the flow control means, and hence the microfluidic manipulations, are completely different in pressure-driven and electrokinetically driven microsystems. Moreover, Knapp et al. do not teach anything regarding fluidic control (their invention is a DNA sequencing device), but simply state that the means for moving fluid samples through microfluidic channels include "electrokinetic, electroosmotic, and electrophoretic systems, as well as micro-pump and valve systems." They provide no information about how to implement fluidic controls.

Claim 1, as currently amended, and claim 8, both require pinching of a sample by applying pressure at both ends of the second channel while the sample is pumped through the second channel. There is no suggestion in the prior art that pinching could be performed in this way.

In the paragraph bridging pages 5 and 6 of the office action, the Taylor et al. patent is alleged to describe "an injection method [that] comprises similar flow patterns as taught by Ramsey (see figs. 2A-3F of US '817)". Moreover, on

page 7 lines 4-6 of the office action, Taylor et al. are said to demonstrate that "a microfluidic system comprising two intersecting channels and using pressure-driven flow must be connected to a pressure source at a minimum of three ends of the channels."

The Applicants believe that the Examiner's analysis of FIGs. 2A-3F in Taylor et al. is not entirely correct. There is no description or suggestion in Taylor et al. of pinched injection. FIGs. 2A to 3F show a total of twelve method steps, but pressure is never applied to three ends of the channels in any of these steps. Not only is there no suggestion in Taylor et al. to perform pinched injection using mechanical pumping, but there is nothing that suggests the specific arrangements as set forth in claims 1 and 8, or otherwise shows them to have been obvious.

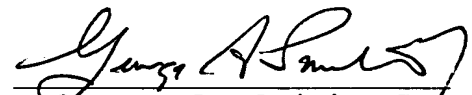
Sklar et al. teach how multiple samples can be introduced into a device (here a cytometer), using a special connection of the ports of an 8-port valve which is modified with engraved cavities in order to create supplementary connections between opposite ports. It would not have been obvious to use the highly specialized 8-port valve of Sklar et al. in combination with Ramsey et al. to arrive at the invention of claims 1 and 8.

It may also be noted that claim 1, as amended, incorporates language taken from cancelled claim 14 calling for the "multi-port valve" to be "switchable between" "a first position. . ." and a "second position where the openings of said first covered channel are connected through said multi-port valve so as to form a closed loop. . .." Moreover, claim 13, which has been rewritten in independent form, is directed to the apparatus of Figs. 2A to 2C, and

requires the multi-port valve to be switchable between "pumping through" the first channel with a closed loop in the second channel and vice versa. Thus, both of the independent claims are directed to an apparatus in which the multi-port valve is operable to provide a closed loop configuration (which has the advantage that the net flow in the loop is very low and dispersion of fluid into the channel forming part of the closed loop is minimized). None of the patents to Ramsey et al., Knapp et al., Sklar et al. and Taylor et al. describes or suggests closed loops. Although the Knapp et al. patent utilizes the term "closed loop" in its title, there the term "closed loop" refers to an iterative method rather than to a closed loop that is part of the apparatus. (See Knapp et al., column 13, lines 46-49.) For this additional reason, the Applicants submit that claims 1 and 13, and their dependent claims should be found allowable.

Applicants respectfully request favorable reconsideration of this application in view of the foregoing amendments and remarks.

Respectfully submitted,
HOWSON & HOWSON

By 

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